DOCUMENT RESUME

ED 302 181 IR 013 540

AUTHOR Engelbart, Doug; Hooper, Kristina
TITLE The Augmentation System Framework.
PUB DATE Jun 86
NOTE 18p.; Paper presented at an Invitational Conference on Multimedia in Education (Cupertino, CA, June 19-20, 1986). For the complete journal, see IR 013 538.
PUB TYPE Journal Articles (080) -- Speeches/Conference Papers (150)
JOURNAL CIT Learning Tomorrow: Journal of the Apple Education Advisory Council; n3 p17-34 Spr 1987

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Change Agents; *Computer Software; *Computer System Design; *Expert Systems; Information Systems; *Man Machine Systems; Skill Development
IDENTIFIERS *Software Development

ABSTRACT

Augmentation systems are composed of things that will add to what the human is genetically endowed with in order to extend the net capabilities that a human or human organization can apply to the problems or goals of human society. A broad brush categorization of the components of an augmentation system includes three distinct though interacting elements: language, artifacts, and methodology. The purpose of the methodology is to frame analysis, not to produce, dictate, or guarantee particular outcomes. It is important to acknowledge the difference between what software designers are doing on a day-to-day basis and what they could be doing. The key to the implementation of the augmentation approach is the development of "high performance teams," i.e., small groups to begin engaging organizational systems and learning how to do this effectively. (5 figures and 7 references) (EW)

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The Augmentation System Framework

Doug Engelbart with Kristina Hooper

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Doug Engelbart and I met in mid-November to discuss his work, and to try to encapsulate the critical points in his approach for the audience of this book. Our focus in this discussion was "Augmentation", the principle context for all of his work.

"Augment" is a transitive verb which is defined by Webster to mean "to make greater, as in size, quantity, strength, etc.; enlarge". Doug uses this term to emphasize the role of technology in a human context; technology is to be designed to increase human capabilities, to extend them in imagined and unimagined ways to change the basic character of communities and to make these more effective.

This perspective on technology is becoming acknowledged quite widely as a critical component in technology development. The use of word processors and other computer tools to assist in human expression and to aid human work—to "augment the human intellect" in acting in the world—presents this approach in contemporary society. Similarly, approaches to technology such as those described in this book which begin with a basic human situation in design, rather than with particular technologies, also exemplify his approach.

It is noteworthy, however, that in the early 1960s when Doug was developing these concepts, they were quite unheard of in the computer science community. The general approach then (and often now if one is to be realistic rather than idealistic for the moment) was the development of technology for its own sake, or for the replacement (or at least minimization) of human involvement.

It is also important to notice that these concepts were quite antithetical to ongoing practices, and questioned some of the most basic assumptions of what was important in an electronic environment.

The kinds of approaches described throughout this book are made possible by just such questioning of perspectives on technology. Hypertext systems are important and useful only when one takes an explicitly human view of the reading process in an information environment; examples of these systems in Doug's Lab twenty years ago provide great prototypes for the linking systems described often in this book for example. Similarly, the entire notion of multimedia presentations assume a human viewer who is benefitting from the richness of the presentations; from a technology point of view such presentations bring a range of processing problems that should clearly be avoided unless these presentations are judged to be of value.

Clearly there are now widespread examples of Doug's influence in the computer environment—not the least of which are the centrality of the act of direct pointing (the mouse) and the concept of simultaneous views on information (windows). Yet the crispness of Doug's analyses continues to invite innovation and inventive implementation, for these analyses are at their heart about the nature of human communities and the opportunities for changes in these communities made possible with technology.

In the following pages I have outlined my recent discussions with Doug, trying to capture the precision of his comments and thinking in rather terse "one-liners" which approximate his descriptions of his framework. As the reader will note this presentation reads like a set of axioms, and not much like prose. Given this, I have provided the reader with elaborations of the ideas which have been reduced to their essence in Doug's formulations. My hope is that my commentary—indicated in italics—will help the reader to appreciate this approach. Both the confused and the interested reader are referred to the articles listed in the Bibliography of this chapter for more detailed descriptions of these issues.

Kristina Hooper

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Components of an Augmentation System Framework

The components of an Augmentation System are the bundle of all things added to what a human is genetically endowed with, the purpose of which is to augment these **basic human capabilities** towards providing the net capabilities that a **human** or **human organization** can apply to the problems and goals of human society.

This is part of an extensive framework which is not an end in itself; it is instead in the formulation of a system that can be used to deal with a range of different issues of human society.

The definition of these "things" can get very bulky; also the description of these in a systematic way is a long term and difficult task, one easily misunderstood and one requiring continual involvement/revision.

This is a long-term mode of analysis, a paradigm for viewing technology and a way to constantly incorporate it into daily life (as a way to influence future life); it is a continual agenda not a short term proposal/project/product ...

Category I: Language, artifacts, methodology and training
A broad-brush categorization of the components of an augmentation system include three distinct though interacting elements: **language, artifacts and methodology.**

Society must **train** humans to use these three different augmentation components in an integrated way.

An example:
Augmentation systems have always existed, and been developed (often unconsciously). Any time back through the ages, augmentation subsystems (by their nature augmentation systems are too big to grab in their entirety; subsystems then provide a good unit for analysis) emerged as a result of continuing **socio-cultural evolution.**

It is almost hopeless to sit down and **design** something this complex.

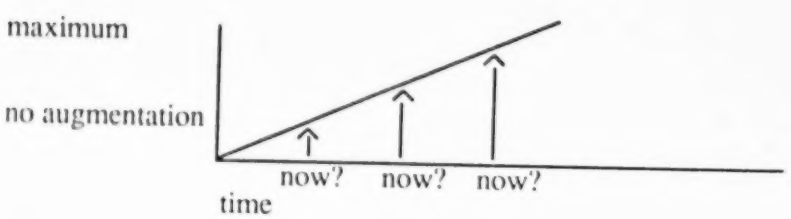
It is critical to realize that positive action can be taken in molding the classes of augmentation subsystems available, while at the same time the design of the results of humans and organizations using these subsystems cannot be predicted nor completely self consciously designed as an output. It is a process for analysis and involvement that is provided, not one particular view of what is to be produced.

The kernel: What do you suppose the limits of capability would be for an organization if it were maximally augmented?

Even the asking of this question is critically far ahead of most organizational analyses (or human analyses). We tend to assume the status quo, and then use training for specific goals (frequently concrete and simple and short range). What happens if an organization or an individual seriously asks this question? This may just be more that half of the benefit of this point of view.

Again, there is no arrogance in this; there is not one point of view of "good futures" or "rightful actions." The purpose of this methodology is to frame analysis, not produce or dictate (nor guarantee) particular outcomes.

First, just where are we now in terms of maximum augmentation?



How can we get to the maximum?
What are the approaches and strategies that will work?

Evolution is the only viable strategy; we must get the evolutionary process going, directing this at "climbing the hill."

Pretty soon we will realize **"bootstrap strategies."**

There is a lot of thinking to do about that.
Certain principles should drop out, including:

During any given period of time, there is a limited set of resources that are applicable to directly exploring the ascent.

Various targeted outcomes/goals can be expected which have several components of value.

In simple terms, there are two categories of value:

(1) how much would the outcome boost our capability in some specified "in-line work" (with a group of planners, one might use resources to boost the ability of these people to do their work), and

(2) how much will the outcome boost the capability to climb the hill **(bootstrapping, evolutionary support)?**

For example, investing the limited resources in augmenting the capability of software engineers would yield both kinds of return. For (1), a great many current-day projects are heavily dependent on software development; for (2), the continued evolution of augmentation systems for any one domain is going to be heavily dependent on software engineering.

The new language component of future augmentation systems will generally include a great deal more than programming languages. In every affected knowledge-work domain, the new ways of thinking, working, and collaborating will be associated with new concepts, new terminology, and new kinds of portrayals (that is, with enhancements to our working language).

Innovations in tools, language, or methods all will impact each other.

For the most part, explicit exploration has only occurred for the tools.

Currently, language and methodology, and the coevolution among all three (tools, language, and methodology) simply don't get explicit exploratory pursuit.

With software, you develop tools for the second class of support, for the improvements in capabilities in climbing the hill.

The cultural crunch will always be in software, not hardware terms.

Software teams will feed back, making each next generation better equipped.

Need **methodologies and skills** directed toward software, toward tools.

Yet, currently software designers are subjects of all this, they are not the researchers.

It is critically important to acknowledge the difference between what software designers are really doing day-to-day and what they might be doing. We often talk about tools, and software designers as tool makers. Yet certainly there are only a very few software designers who have the training and skills required to really make tools. Typically today's softtware developers are trained in engineering, computer science or hacking, most often in the narrow as opposed to general sense. That's fine. It is simply important that we all remember the differences, and realize we have yet to make any concerted effort in developing electronic tool makers, and then in developing tools for augmentation in any significant or sustained way.

If it is not the software designers, just who are the people who work with methodologies and training? Who are the people who consider languages for augmentation that are not concretely programming languages?

In any given **knowledge-work domain**, there is a special set of **concepts, terminology,** and **portrayals**. And, the tools developed have an impact on the language.

This requires explicit exploration.

Currently this topic does not get this exploration.

Realize that this topic didn't get attention in the 1960s when it was first articulated by Doug; this is easy to understand given the newness of the public concept within computing worlds. However, do not be deceived into thinking it gets much attention now 'lest you lull yourself into inappropriate complacency.

What seems necessary to me is the development of a completely new discipline that embraces the whole augmentation system.

Think of it as similar to architecture, a whole-system discipline that integrates in a coordinated way the specialty fields of structures, heating, electricity, plumbing, and more.

It is interesting to consider from which existing university academic department such a whole system might emerge.

It seems that old time Rhetoric Departments had an explicit formal focus on information organization and on systematic explanation. Recently, this kind of department seems more concerned with public speaking, or somehow with the traditions of the classics (which did indeed emphasize this perspective to some degree). Currently Departments of Library Science do approach this topic, but typically, these departments deal with books rather than information as their basis. One would think that Departments of Computer and Information Sciences might take a stab at it all, but these departments are generally focused on technology. Sometimes Business Schools do address some of these concepts, in the context of organizational management; yet the translation to technology-rich environments—environments now possible that are typically considered futuristic by non-technologists—is almost non-existent.

What are the methodologies which I apply in collecting ideas and organizing them?

Currently I have a set of haphazard ways to organize things. And we all have haphazard ways of piecemealing methodologies of organization together.

Why not put together a whole "academic department" in this subject? Or a specific department in a "work environment"?

Why not think of augmentation as a system, and provide it with formal tools of analysis as well as extensive settings for experimentation?

What are the practical strategies that will allow our society to pursue high-performance augmentation?

My strategy would be that the pursuit should start with small groups.

Small groups are preferable to large groups because of: shorter evolutionary cycles; more economical scale of experiments; more "cultural mobility."

Small groups are preferable to individuals because: exploring high-performance augmented collaboration is at the center of opportunity.

These small groups will be the scouting parties sent ahead to map the pathways for the large organizational group[s] to follow.

I have come to call these exploratory groups, "high-performance teams."

One early-role candidate would be to support **working conferences**; this would provide a very valuable service, and match well with early augmentation possibilities.

It would also provide very direct interaction with "outside-world" conference people. And it would be of limited duration, and its cyclic nature would allow for debriefing and system updates.

Since there would be a new set of paricipants for each cycle with this approach, more (key) people would gain new perceptions of what high-performance augmentation can bring into their organizations.

Another closely related role for a high-performance support team would be as an "integrator" for a large project of special-interest community.

In this role the support team would support dialog, analyze the contributions, integrate them into a "project handbook," and generate special "portrayals" (presentation or documents).

How can you chart the terrain ahead?

Basically, you need to send **scouting parties** ahead to map the territory for the main party.

You need high performance teams!

This notion is key to the entire implementation of the augmentation approach. It provides a very concrete place to begin engaging organizational systems, and learning how to do this effectively. These teams may be planners, they may be software designers, they may be facilitators. What is important is that they be chosen strategically for bootstrapping.

You also need outposts for these teams.

There are some teams currently scattered about by accident, but they are typically not carrying out the systematic exploration that is needed "out there"; we need a **plan** for putting the teams out, and we need a **large number** of them.

I have barely begun to understand the profoundness of these assertions. Particularly I am just beginning to understand that some of the best first teams to work with are facilitators. For teams of high performance facilitators (of information exchange, of cooperative work, of changing organizational units from the inside) can have a broad evolutionary effect on ongoing activities. They can be critical in the coevolution of technological and personal changes, which enable organizational changes. For they can contact many organizational units, planting the seeds of (and tools for) evolutionary changes.

The first expenses should be put toward the development of outposts.

The initial task is to determine just what people would do here.

Another central task is to determine just who would employ these teams.

It is important to acknowledge that such an approach is pareto-optimal; everyone will benefit. Yet the questions of who stands to benefit the most,who will show returns most quickly, or "just who is in this business", are real showstoppers. They are especially difficult in the current U.S. business and research environments in which we find ourselves.

The figures which follow provide a self-contained overview of Engelbart's analysis to complement these text descriptions.

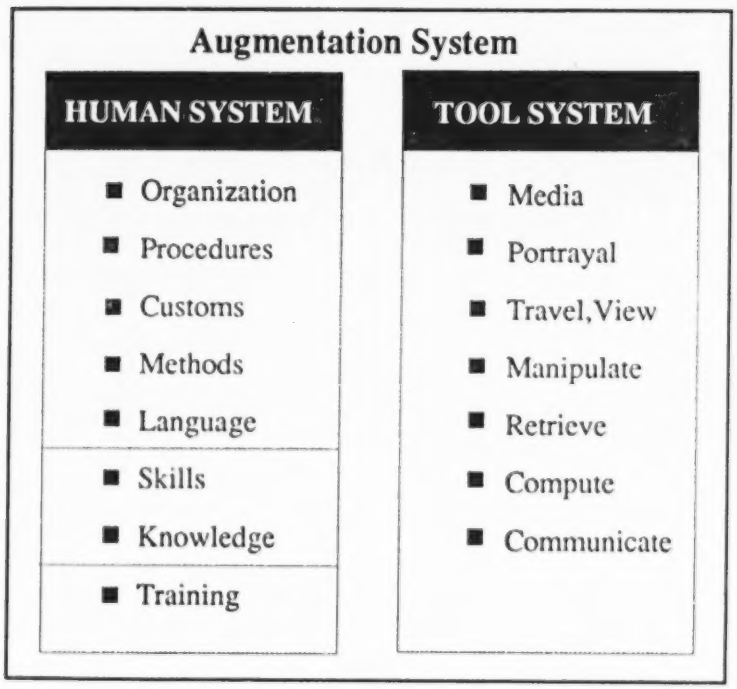


Figure 1.
It is important to consider a two-part augmentation system: The Human System and The Tool System.

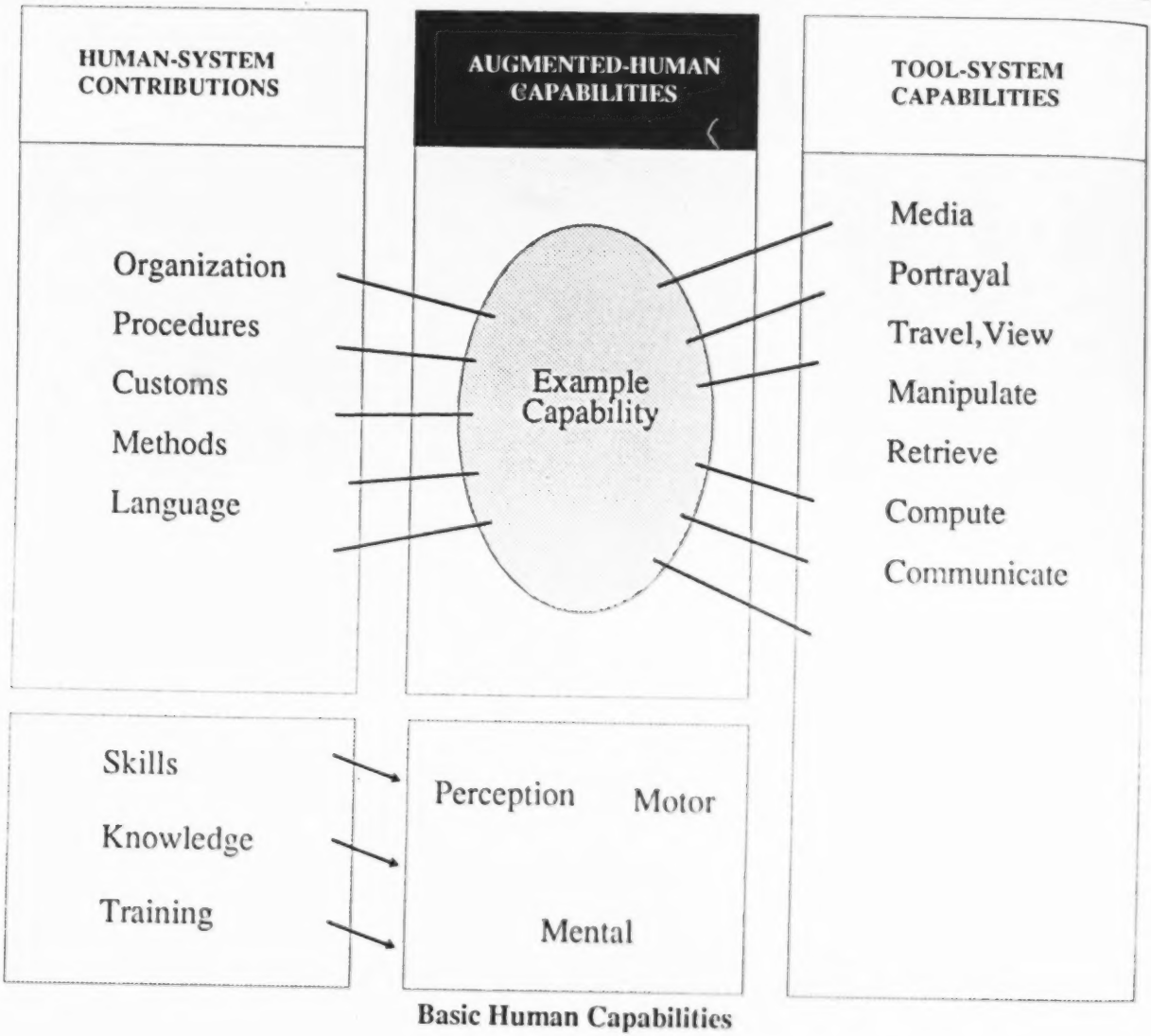


Figure 2.
Most of our capabilities are composites: Any Example Capability can be thought of as a combination of human-system and tool-system contributions. These capabilities come from the human having the necessary skills and knowledge to employ these augmentation systems.

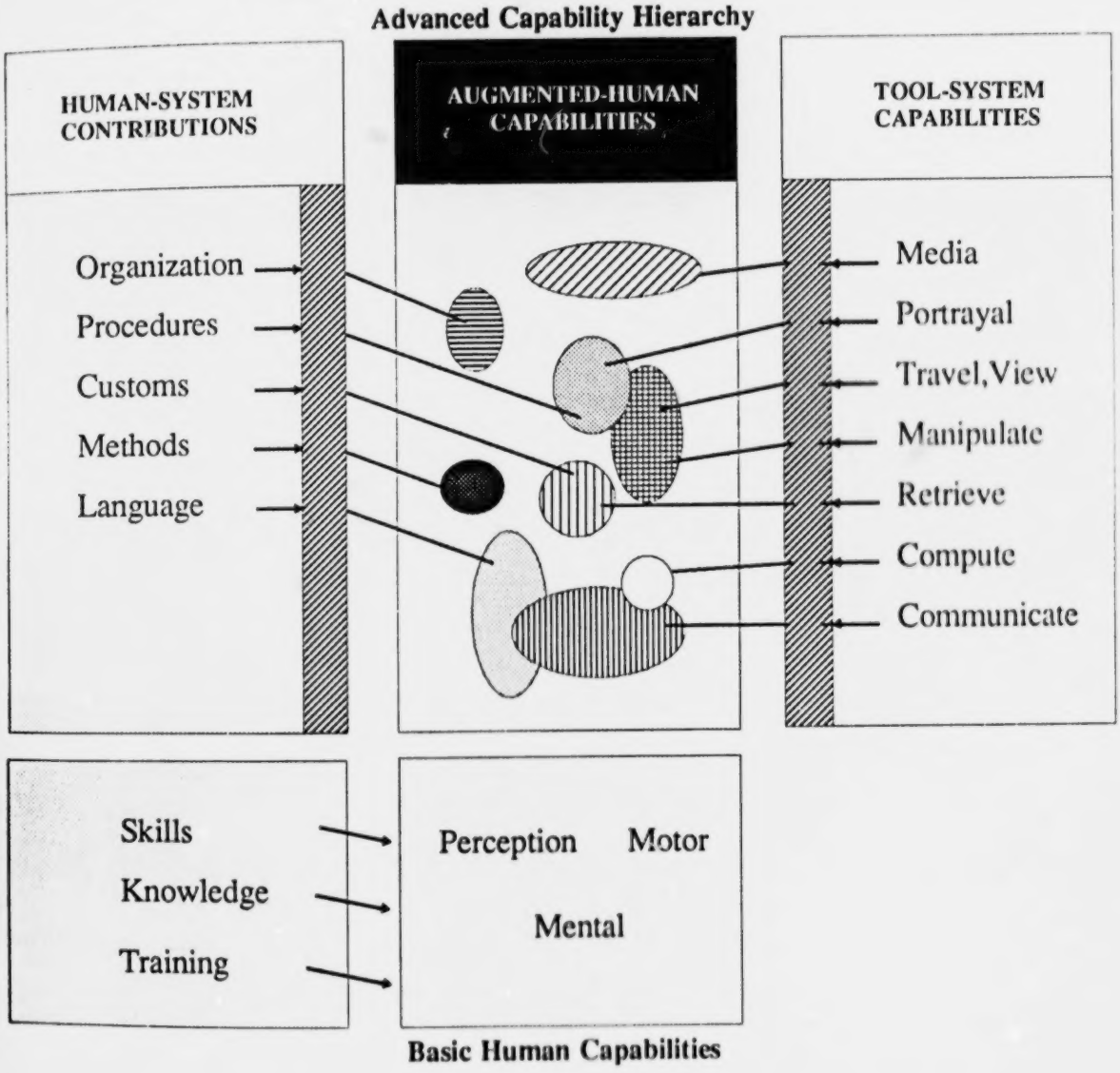


Figure 3.
Our capabilities grow hierarchically: each new capability interacts with the wide range of existing (interrelated) capabilities.

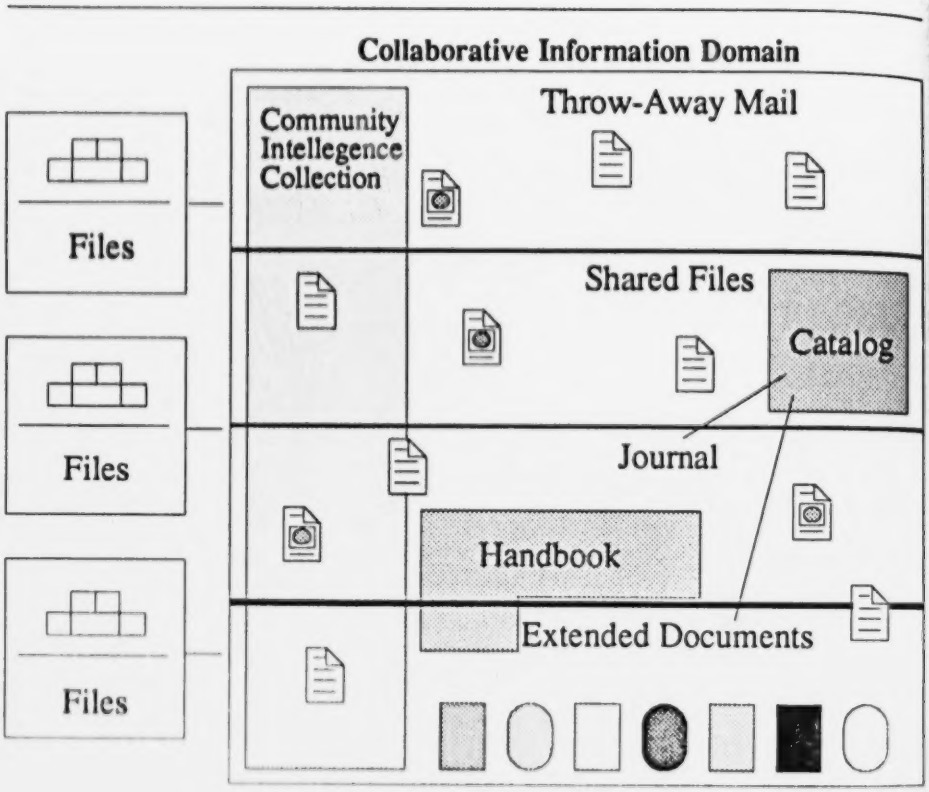


Figure 4.
A document linkage system forms a critical focus for the Community; it adds more and more power to how individuals in a Community can collaborate. For example, links give added value to ***Shared Files****. They also can provide value to what is typically* ***"Throw-away Mail"****; they provide a way to interlink this mail and make it relevant to any other element in the shared domain. The* ***Journal*** *in such a system is the set of online "published works" of the community. Individuals commit to these documents and deliberately make them available to everyone, for reading and for comment. Since documents in the journal can refer to relevant documents directly, readers can quickly obtain the context for considering new presentations; this allows for very rapid and condensed recorded dialog on these new idea presentations.* ***External Documents****—books on your desktop, articles on library bookshelves, etc.—are located through a* ***Catalog*** *which also provides access to Journal documents.*
There are a number of different sets of documents and partial documents. The ***Community Intelligence Collection*** *provides information about what is being observed by the community of outside activities; this community-specific view of relevant outside activities is important for the survival and adaptation of the community. The* ***Handbook*** *represents the status of the community at any time; it is produced by deliberate sifting, evaluating and integrating processes of the community.*

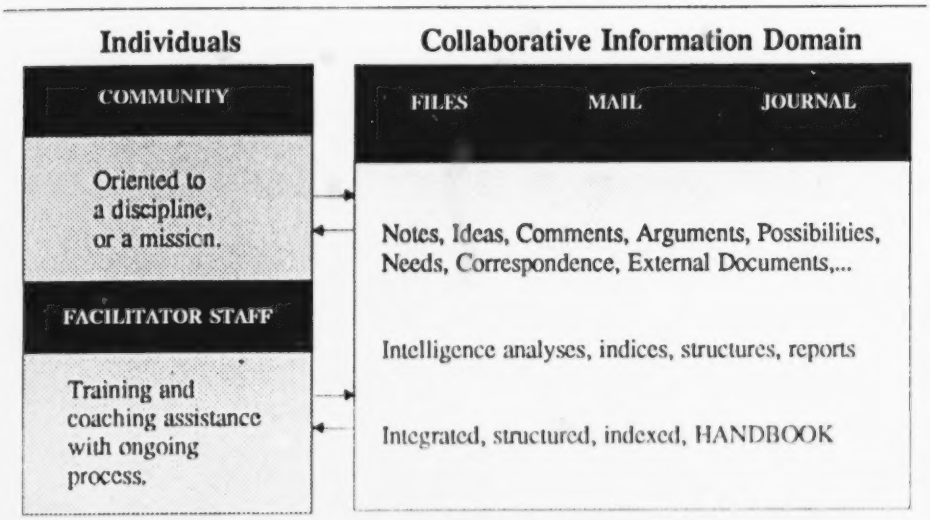


Figure 5. *Facilitation Teams provide training and coaching to the community. In addition they enhance and make explicit the activities of the community, relating these to the document linkage system of this community. In addition this group can add value by enabling records to be sorted in standardized formats for later easy access and analysis, principally in the Handbook. This facilitation allows for the effective evolution of the community. This organizational evolution can positively affect outcomes, as well as positively influence other organizational units; it is therefore an excellent focus for the immediate investment of tools.*

Summary

As it was 1960, this enterprise is still just getting started. And it is having trouble gaining the kind of foothold required for the scale of endeavor required. Yet the technological changes in the last twenty years do make some of the concepts raised by Doug more clear to more people. For though the preceding discussion can be taken as a broad format for social change, this approach has clear technological implications.

The mouse was invented by Doug, for example, as a means to provide humans with effective tools for interactions, with information and with each other in group meetings. Hypertext conventions were developed in the early days in Doug's lab in order to allow individuals to expand and contract information available to them, as well as to review documents, to generate group documents, and to browse dense materials. And video teleconferencing systems were demonstrated that allowed long distance communications, with shared computer resources.

And there are clearly more technologies to emerge from this perspective, as well as new analyses allowed by the investigation of their use.

It's all coevolutionary. What is critical is that more and more people understand Doug's central message—a timeless message—so that we can all get on with getting better at all of this, combining our technological might with our analytical and experiential skills.

Bibliography

Engelbart, D.C., "A Conceptual Framework for the Augmentation of Man's Intellect," in Vistas in Information Handling, Howerton and Weeks (Editors), Spartan Books, Washington, D.C., 1963, pp. 1–29.

Engelbart, D.C., "Coordinated Information Services for a Discipline—or Mission-Oriented Community," Proceedings of the Second Annual Computer Communications Conference in San Jose, California, Jan. 24, 1972—also, Published in "Computer Communication Networks," R.L. Grimsdale and F.F. Kuo editors, Noordhoff, Leyden, 1975. (AUGMENT, 12445,)

Engelbart, D.C., "Evolving the Organization of the Future: A Point of the Stanford International Symposium on Office Automation, March 23–25, 1980, edited by Robert Landau, James Bair, Jeannie Siegman, Ablex Publications Corporation, Norwood, N.J. (AUGMENT, 80360,)

Engelbart, D.C. "Collaboration Support Provisions in AUGMENT," Proceedings of the AFIPS Office Automation Conference, Los Angeles, California, February 20–22, pp. 51–58. (OAD, 2221,)

Engelbart, D.C., "Toward High-Performance Knowledge Workers," Proceedings of the AFIPS Office Automation Conference, San Francisco, California, April 5–7, 1982, pp. 279–290. (AUGMENT, 81010,)

Engelbart, D.C., "Authorship Provisions in AUGMENT," Proceedings of the 1984, COMPCON Conference, San Francisco, California, February 27–March 1, pp. 465–472. (DAD, 2250,)

Engelbart, D.C., "Workstation History and the Augmented Knowledge Workshop," Conference Proceedings of the ACM Conference on the History of Personal Workstations, Palo Alto, California, January 9–10, 1986, pp. 73–83. (AUGMENT, 101931,)

Douglas C. Engelbart

Douglas C. Engelbart is a senior scientist with McDonnell Douglas/ISG, Cupertino, California. His professional focus is on the application of computer and communications technologies aimed to bring exceptional new capabilities to individuals and organizations that are heavily dependent upon knowledge work.

A pioneer in office automation, Engelbart's innovations at SRI International in the '50s and '60s included the mouse, two-dimensional editing, multiple-window screens, cross-file editing, outline and idea processing, formatting directives, integrated help systems, and a full-scale electronic mail system. Other Engelbart innovations currently being implemented include shared-screen teleconferencing, composite text-graphics files, in-file addressing and cross-conference links, multiple viewing modes for text, and the universal user interface front-end module.

In recent years, Engelbart's studies have expanded into strategies for large organizations facing rapid changes in technology, competition, and operating environments.